

REMARKS

Claims 21, 23, 25, 28, 31, 33 and 34 have been canceled. Claims 19, 20, 22, 24, 26, 27, 29, 30, 32 and 35 to 37 and new Claims 38 to 40 are active in the case. Reconsideration of this application is requested.

The present invention relates to a process of producing a resin encapsulated semiconductor device.

Claim Amendments

Support for the amendments made to Claims 19, 36 and 38 can be found in Claims 23, 25, 28, 33 and 34 and on page 5, lines 3-8 and in Items (2) and (3) of Example 1. With respect to the requirement that the temperature for molding and curing the epoxy resin composition be less than the decomposition of the foaming agent, it is [pointed out that page 5, line 3 of the text discloses that the decomposition temperature of the foaming agent is at least 180° C, but that the temperature required for molding the epoxy resin is established at a temperature that is lower than about 180° C (page 5, lines 6-7). Items (2) and (3) of Example 1 show that molding and curing were actually carried out at a temperature of 175° C which, of course, is less than 180° C. Accordingly, one of skill in the art would understand that the temperature for molding and curing the epoxy resin composition is less than the decomposition temperature of the foaming agent.

Support for new Claims 39 and 40 can be found on page 6, lines 13-21 of the text. None of the newly submitted claims introduce new matter into the case. Entry of the new claims is respectfully requested.

Prior Art Rejection

Claims 19-22, 25, 26 and 31-37 stand rejected based on 35 USC 103(a) as obvious over Kagoshima et al, U. S. Patent 5,274,006 in view of Starkey, U. S. Patent Pub 2003/0001140. This ground of rejection is respectfully traversed.

Applicants point out with respect to the invention as claimed that the flame retardant epoxy resin composition employed in the invention is molded and cured at a temperature lower than the decomposition temperature of the foaming agent. Because of this fact, the foaming agent remains un-decomposed in the cured product of the composition. The un-decomposed foaming agent that is present readily decomposes at combustion temperatures, thereby generating a gas during combustion. The result is the production of a resin encapsulated semiconductor device that has excellent flame retardancy (page 4, line 22 to page 5, line 2). In addition, because the composition does not contain a brominated epoxy resin or antimony trioxide, it does not give rise to environmental or human toxicity problems. Furthermore, the resin encapsulated semiconductor device also exhibits excellent resistance to high temperatures and humidity and reliability (page 2, lines 12-17; page 9, line 15 to page 10, line 3).

As to the Kagoshima et al patent, the same discloses a foamable epoxy resin composition that is comprised of an epoxy resin, a curing agent and a foaming agent, wherein the objective of the disclosure is to provide a liquid material that produces a light, rigid and dense foamed material. However, the patent discloses that the decomposition of the foaming agent and curing reaction of the epoxy resin simultaneously occur by heating the composition (col 6, lines 47-50 and 65-67). This means that the temperature of the molding and curing of the composition is equal to or higher than the decomposition temperature of the foaming agent. As a result, no un-decomposed foaming agent remains in the cured product, and that a gas can no longer be generated from within the cured product. Therefore, a resin encapsulated

semiconductor device having excellent flame retardancy can not be produced from the composition of the patent.

The Starkey publication does not contain any disclosure material at the point of distinction of the present invention over the Kagoshima et al patent. Further, the Starkey publication discloses a molding compound that is used to encapsulate electronic packages. The gist of the disclosure appears to be a molding material that contains a phosphor that converts UV/blue light to visible white light. Such a disclosure is irrelevant to the present invention. Accordingly, withdrawal of the rejection is respectfully requested.

Claims 19-37 stand rejected based on 35 USC 103(a) as obvious over Lamon et al, U. S. Patent 5,453,453 in view of Czaplicki et al, U. S. Patent 6,846,559; Jannic, U. S. Patent 5,019,605 and Starkey, U. S. Patent Pub 2003/0001140. This ground of rejection is respectfully traversed.

The Lamon et al patent discloses a fire-resistant, halogen-free epoxy composition that, besides the epoxy resin, also contains a foaming agent and a curing agent. The composition emits low amounts of smoke and toxic gas while burning. The composition is useful in aerospace applications for bonding, sealing and/or insulating metal, plastic and composite parts. However, it is important to note that in the patent, expansion of the composition, which can be in the form of a paste or film, occurs simultaneously with curing of the material. The disclosure in the last paragraph of column 2 states that the foaming agent (by decomposition) permits the volume of the composition to increase during subsequent heat curing. Further, the disclosure at column 6, lines 33-37 is consistent with the statement in column 2 by stating that that a paste or uncured film can be expanded by polymerization. The foaming agent provides a rate of expansion of up to 400 % as the composition undergoes curing. Clearly, this simultaneous curing and foaming of the composition is contrary to the requirements of the presently claimed invention, and therefore does not describe a resin encapsulated

Application No. 10/625,512
Reply to Office Action of September 27, 2005

semiconductor device that exhibits excellent flame retardancy as does a product that is prepared by the process of the present invention.

The disclosures of the secondary references do not lead one of skill in the art to the requirements of the present process as amended in this response where it is essential to maintain the temperature employed for the molding and curing of the composition of the invention must be kept lower than the decomposition temperature of the foaming agent. Accordingly, the obviousness ground of rejection is believed obviated and withdrawal of the rejection is respectfully requested.


It is submitted that this application is now in condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.
Norman F. Oblon

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413-2220



Frederick D. Vastine
Registration No. 27,013